

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of:)	
)	
Implementation of Section 224 of the Act;)	WC Docket No. 07-245
Amendment of the Commission's Rules and)	RM-11293
Policies Governing Pole Attachments)	RM-11303
)	FCC-07-187
)	

TO: THE COMMISSION

REPLY COMMENTS OF EXTENET SYSTEMS, INC

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ExteNet Systems, Inc. ("ExteNet") submits these reply comments in the above-captioned proceeding pursuant to 47 CFR section 1.415 regarding the pole attachment Notice of Proposed Rule Making ("Notice").¹ As a small telecommunications company in the business of building distributed antenna systems ("DAS"), ExteNet's ability to compete with larger companies relies on attaching wireless attachments (e.g., remote radioheads, antennas, primary and auxiliary power supplies and associated equipment) to utility poles. Nondiscriminatory access to utility poles at reasonable rates allows DAS companies, like ExteNet, to provide greatly improved wireless services to customers.

¹ *Implementation of Section 224 of the Act; Amendment of the Commission's Rules and Policies Governing Pole Attachments*, WC Docket No. 07-245, RM-11293, RM-11303, Notice of Proposed Rulemaking, FCC 07-187, 73 F.R. 6879 (rel. Nov. 20, 2007) ("Notice").

ExteNet reviewed the comments submitted in response to the Commission's Notice and generally supports the comments of the telecommunications companies and incumbent local exchange carriers ("ILECs"). However, ExteNet must reply to the comments of many electric companies who appear reluctant if not altogether unwilling to allow wireless attachments fair access to their utility poles at reasonable rates.

ExteNet submits these reply comments to (1) answer the safety and radio frequency ("RF") concerns raised in the comments of the electric companies, (2) refute arguments advanced by some of the electric companies regarding why they should be allowed to charge more than a reasonable rate for wireless attachments, and (3) demonstrate that unreasonable limitations on access to existing utility poles for wireless attachments will ultimately result in additional utility poles set in the rights-of-way, contrary to the established policies to limit the number of redundant structures in the rights-of-way.

ExteNet strives to present a complete picture for the Commission by providing balance to the one-sided positions of some of the electric companies. Once the Commission has all the relevant information regarding wireless attachments, ExteNet requests that it enact fair and well-reasoned rules to ensure access to public utility infrastructure for DAS wireless attachments.

I. THE ELECTRIC UTILITIES MAKE UNSUBSTANTIATED OBJECTIONS TO WIRELESS ATTACHMENTS BASED ON ALLEGED SAFETY ISSUES AND RF EMISSIONS.

Safe installation and maintenance of wireless attachments are of paramount importance to ExteNet. ExteNet strictly complies with all applicable governing standards, rules, laws, and statutes, including without limitation, those of the Commission, the National Electric

Safety Code (“NESC”), the National Electric Code (“NEC”), the Occupational Safety and Health Act (“OSHA”) or its state equivalent, state and local building codes, and pole owner construction and maintenance standards.

ExteNet currently has wireless attachment agreements in place with approximately 25 electric companies and ILECs across the nation, including five of the electric companies who made objections to wireless attachments in their response to the Commission’s Notice.² However, despite ongoing wireless attachment relationships and strict adherence to the recognized standards for safety, several electric companies raised unsubstantiated objections to wireless attachments in their comments with the implication that wireless attachments are less safe than other attachments to a utility pole.

Wireless attachments are just as safe as other attachments.

A. ExteNet Complies with All Applicable Safety Rules and Regulations When Installing and Maintaining Wireless Attachments and Often Improves Utility Infrastructure.

ExteNet employs best practices and qualified individuals when installing and maintaining its wireless attachments. Pole attachments are generally governed by the NESC, which is the industry standard in all states except California. Electric companies often clarify and extend the application of the NESC by developing their own standards. ExteNet works closely with electric companies to receive specific engineering approval for each wireless attachment, thus addressing any safety concerns.

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² ExteNet has pole attachment agreements in place with Ameren Services Corporation, AT&T, and National Grid, which allow pole top antenna attachments, and Florida Power & Light and NSTAR, which allow communication space antenna attachments.

The Comments of the Coalition of Concerned Utilities (*"Comments of the Coalition"*) set out a veritable "laundry list" of safety concerns without providing references or any concrete reasons for concern.³ For example, it asks, "What is the potential that wireless equipment will fall onto or otherwise interfere with energized facilities?"⁴ Wireless attachments are just as safe as all other pole attachments. In fact, the potential for wireless attachments to fall is less than the potential for energized facilities to fall because an electric facility is a continuous wireline that can be taken down at any point along the line by a falling tree or other such force. By contrast, a wireless attachment is affixed securely to a single utility pole without any extending wires.

Paradoxically, wireless attachments may actually improve the strength of utility poles because ExteNet often replaces utility poles with taller and stronger poles to accommodate pole top antenna attachments. These replacement poles are specifically engineered using the most up-to-date structural standards and national codes to accommodate the presence of the antenna. Some electric companies request utility pole replacements even when they do not allow pole top antenna placement.

For example, ExteNet is currently working with a Coalition of Concerned Utilities member, NSTAR, in connection with a DAS network in the Boston metro area. During the course of evaluating make-ready preparations, NSTAR discovered six utility poles that were in such poor condition they needed to be replaced regardless of any attachments to be made by

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³ In the Matter of Implementation of Section 224 of the Act; Amendment to the Commission's Rules and Policies Governing Pole Attachments, WC Docket No. 07-245, *Comments of the Coalition of Concerned Utilities* at 45–48 (filed March 7, 2008) (*"Comments of the Coalition"*).

⁴ *Id.* at 45.

ExteNet. NSTAR now requests that ExteNet replace those dangerous poles so that they will no longer be a hazard to surrounding community.

Even when ExteNet is not replacing a pole, ExteNet works with the electric company to make engineering assessments of the structural integrity of each utility pole so that necessary reinforcements can be made as part of the make-ready work for the wireless attachments. This improves the electric company's overall utility pole infrastructure.

ExteNet has been working with National Grid, another member of the Coalition of Concerned Utilities, for nearly a year on a DAS network in Rhode Island. ExteNet has complied with all of National Grid's safety standards in designing its wireless attachments, and National Grid is in the process of approving ExteNet's pole top attachments. National Grid is requiring that ExteNet finance a complete survey of a portion of National Grid's utility poles so that National Grid can make its poles safer for the surrounding community, irrespective of ExteNet's attachments.

Electric companies typically require that installations above the electric facilities of pole top antennas be done by their own crews or approved contractors. ExteNet pays the full cost of this work, thus removing any burden on the electric company. Work done in the communication space is always done by qualified workers, so electric companies should not be concerned about sub-standard work on their poles.

The experience of some electric companies working with DAS companies, such as ExteNet, demonstrates the feasibility of safe application of wireless attachments, including pole top antennas. As the above examples show, ExteNet provides substantial amounts of money and resources upfront that ultimately improve the quality of the electric companies' utility pole

infrastructure. All above-ground utilities are vulnerable to extreme weather or other acts of God that may periodically interfere with electric, telephone, cable, and wireless services, which is why ExteNet takes every precaution to ensure safety.

B. ExteNet's Wireless Attachments Comply with the Commission's RF Emission Levels.

ExteNet's DAS networks transmit at very low power, resulting in RF emission levels far below the Commission's requirements.⁵ The Commission sets maximum permissible exposure ("MPE") levels for public and occupational RF exposure, which is the limit a person may be exposed to RF "without harmful effect and with an acceptable safety factor."⁶

The *Comments of the Coalition* raised concerns surrounding RF exposure, such as health effects, warning signs, and de-energizing switches.⁷ ExteNet understands that wireless attachments are relatively new utility pole attachments, so it works closely with all pole owners to address any concerns they may have.

ExteNet commissioned an evaluation of its typical wireless attachment configuration to confirm compliance with the Commission's requirements. The resultant study showed that for public RF exposure, ExteNet's typical configuration produces RF emissions that are 0.055% of the Commission's allowance on the ground and 11% at the same elevation as the antenna.⁸ With respect to occupational RF exposure, ExteNet's typical configuration is in compliance with the Commission's MPE level for workers within the recommended time limits for working in

⁵ See *Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiations*, Bulletin No. 65, FCC Office of Engineering and Technology (Ed. 97-01) (August 1997).

⁶ *Id.* at 3.

⁷ *Comments of the Coalition* at 46.

⁸ Statement of Hammet & Edison, Inc., Consulting Engineers, to ExteNet Systems, Inc., at 2 (April 3, 2008) (attached as Appendix A).

direct proximity to the antenna. To provide an additional margin of safety on every utility pole with wireless attachments, ExteNet provides RF alert signage and a shut off switch to completely de-energize the antenna when workers expect to be in direct proximity to the antenna for a prolonged period of time.

ExteNet is sensitive to the electric companies' concerns; however, irrational and unsupported fears should not be a basis for limiting access to utility poles for wireless attachments under the guise of "safety." The Commission has established rules for RF exposure levels, and so long as wireless attachments are within these safe levels, wireless attachments should receive non-discriminatory access to utility poles.

II. ELECTRIC UTILITIES MAKE MISLEADING ASSERTIONS REGARDING WHY THEY SHOULD BE ABLE TO CHARGE MORE FOR WIRELESS ATTACHMENTS.

Many of the electric companies urge the Commission to allow them to charge whatever they choose for wireless attachments without limit.⁹ They use several justifications for charging increased, and often unreasonable or effectively prohibitive, rates for wireless attachments rather than applying charges in line with the regulated attachment rate per section 224(d)(1) of the Act. These justifications may be misleading and require clarification.

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⁹ *Comments of the Coalition* at 44–45; In the Matter of Implementation of Section 224 of the Act; Amendment to the Commission's Rules and Policies Governing Pole Attachments, WC Docket No. 07-245, *Comments of Alabama Power, Georgia Power, Gulf Power, and Mississippi Power* at 25 (filed March 7, 2008) ("*Comments of Alabama et. al.*"); In the Matter of Implementation of Section 224 of the Act; Amendment to the Commission's Rules and Policies Governing Pole Attachments, WC Docket No. 07-245, *Initial Comments of Florida Power & Light and Tampa Electric Regarding ILECS and Pole Attachment Rates* at 17 (filed March 7, 2008) ("*Comments of FP&L and TECO*"); In the Matter of Implementation of Section 224 of the Act; Amendment to the Commission's Rules and Policies Governing Pole Attachments, WC Docket No. 07-245, *Comments of PacifiCorp, Wisconsin Electric Power Company, and Wisconsin Public Service Corporation* at 21 (filed March 7, 2008) ("*Comments of PacifiCorp et. al.*").

A. Wireless Attachments Are Not Unique and a Uniform Formulaic Rate May be Applied.

The *Comments of Pacifcorp et. al.* capture the sentiment of some of the electric companies asserting that the Commission should avoid mandating a reasonable rate for wireless attachments because each situation is too unique.¹⁰ The *Comments of Pacifcorp et. al.* state, “It would be difficult to establish a formula that would deal with the unique technical issues associated with wireless attachments.”¹¹ They continue by offering the rationale that, because there are fewer wireless attachments, they should be able to charge without restraint.¹²

Wireless attachments are not unique, and the standard telecommunications rate may be used to calculate a wireless attachment rate by multiplying it by the number of feet exclusively occupied by a wireless attachment on a utility pole. Verizon and AT&T and a number of electric companies are already using this approach for calculating the rate for wireless attachments. This works well for telecommunications companies, such as ExteNet, because their wireless attachments are just another instance of telecommunications attachments.

The *Comments of FP&L and TECO* assert that the “size, shape, construction and burden of wireless attachments are too varied and non-uniform to adopt and implement any uniform formulaic approach.”¹³ But like many others, these companies have extended a uniform

¹⁰ *Comments of Pacifcorp et. al.* at 21.

¹¹ *Id.*

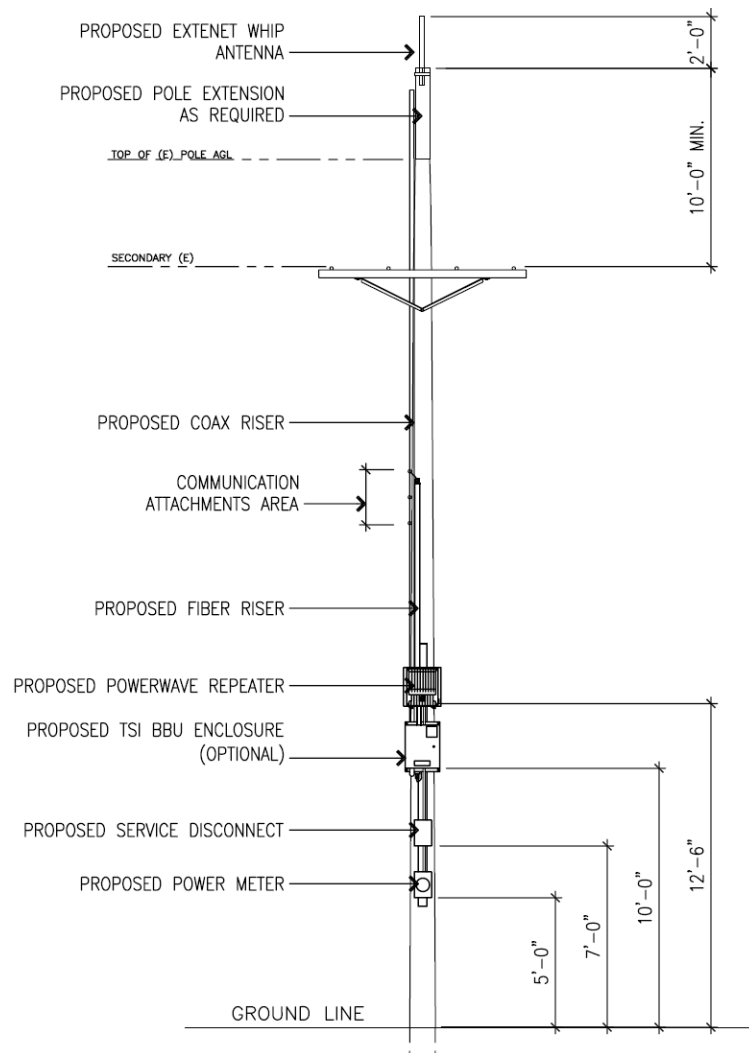
¹² *Id.* at 22.

¹³ *Comments of FP&L and TECO* at 17.

formulaic rate to ExteNet that is largely based on the telecommunications rate and the number of feet occupied by the wireless attachment on the utility pole.

DAS wireless attachments are typically configured with an antenna, radio equipment, battery backup unit, power disconnect, and meter on the utility pole. These components are relatively standardized within a reasonable range of sizes and configurations due to a fairly small number of manufacturers and the economies of conformity for effective installation and maintenance.

Below is a drawing of a standard ExteNet wireless attachment.



This basic configuration is often modified to meet the requirements of individual electric companies. For example, some electric companies do not allow power meters on the pole, so a separate stub pole or pedestal must be set in the right-of-way to accommodate the meter.

Electric companies can charge a fair and reasonable rate by multiplying the number of feet exclusively occupied by the wireless attachments by the telecommunications rate. This is the approach many electric companies and ILECs are already using without difficulty.

B. ExteNet Pays for all Make-Ready Work Required to Accommodate Wireless Attachments.

A few electric companies have suggested that wireless attachments should be subject to an unregulated rate set by the electric company because wireless attachments require make-ready accommodations.¹⁴ The *Comments of Alabama et. al.* and the *Comments of the Coalition* imply that electric utilities are absorbing the costs of accommodating wireless attachments. This implication is misleading and inaccurate.

The *Comments of Alabama et. al.* state that wireless attachments differ significantly from wireline attachments in terms of make-ready, pole replacement, removal and/or repositioning and that “these differences can be costly” and are not “considered in the current telecom rate formula.”¹⁵ This implies that a market-based approach to wireless attachments rates is needed so that electric companies can recover the costs they incur accommodating wireless attachments. However, electric companies do not incur these costs.

Like other DAS telecommunications companies, ExteNet pays hundreds of thousands of dollars a year in application fees and make-ready costs to compensate electric companies for

¹⁴ *Comments of Alabama et. al.* at 26; *Comments of the Coalition* at 47–48.

¹⁵ *Comments of Alabama et. al.* at 26.

every effort extended to accommodate its wireless attachments. Agreements for pole attachment licenses almost unequivocally require the attacher to pay in advance for the full cost of engineering and make-ready work in addition to the recurring attachment rate.

Because ExteNet pays the upfront costs, it knows that assessing the feasibility of pole top wireless attachment is particularly “time consuming and expensive;” however, those costs are not borne by the electric companies.¹⁶ The implication that these costs are incurred by electric company is misleading and offers no justification for a market-based approach to wireless attachment rates.

A market-based approach to wireless attachment rates on top of these upfront costs, and resulting improved infrastructure, sometimes make expanding wireless services to customers through DAS networks cost prohibitive. Wireless attachments deserve a reasonable attachment rate per section 224(d)(1) of the Act because telecommunications companies, such as ExteNet, pay all upfront engineering and make-ready costs to accommodate the wireless attachments.

C. Wireless Rates in Excess of the Regulated Telecommunications Rate Are Unreasonable Under 47 U.S.C. §224(d)(1) and Result in a Windfall for Electric Companies.

Allowing electric companies to set their own wireless attachment rates goes against the purpose of 47 U.S.C. section 224(d)(1) and results in a windfall for the electric companies.

Section 224(d)(1) states, “a rate is just and reasonable if it assures a utility the recovery of not

¹⁶ *Comments of the Coalition* at 47–48 (implying that Coalition members incur the costs of accommodating wireless attachments).

less than the additional costs of providing pole attachments.”¹⁷ ExteNet wants to pay a fair and reasonable rate for its wireless attachments so that they are not subsidized by electric rate payers. However, it cannot continue to pay monopoly prices, touted as “market-based,” and ask its customers to generate an economic windfall on behalf of the electric companies.

Progress Energy claims that pole attachments interfere with its core mission.¹⁸ Yet, it makes sure it is well-compensated for the inconvenience by charging over 120 times its regulated rate for a single foot wireless attachment. This rate cannot be justified as reasonable cost recovery. ExteNet is currently trying to negotiate a more reasonable rate with Progress Energy. ExteNet strongly disagrees based on actual experience with the *Comments of FP&L and TECO*, which state, “Private negotiations appear to be working just fine.”¹⁹

Small telecommunications companies, such as ExteNet, lack sufficient bargaining power to oppose large electric companies that seek to control access to utility poles at rates of their choosing without regard to the cost-recovery model. The Progress Energy situation exemplifies the difficult position DAS companies encounter when trying to build new telecommunications networks—either accept unreasonable rates or forego providing telecommunications services in the recalcitrant electric company’s service area.

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¹⁷ 47 U.S.C. § 224(d)(1) (2005).

¹⁸ In the Matter of Implementation of Section 224 of the Act; Amendment to the Commission’s Rules and Policies Governing Pole Attachments, WC Docket No. 07-245, *Comments of American Electric Power Service Corporation, Duke Energy Corporation, Entergy Services Company, PPL Electric Utilities Corporation, Progress Energy, Southern Company, and Xcel Energy Services Inc.*, at 8 (filed March 7, 2008) (“*Comments of AEP et. al.*”).

¹⁹ *Comments of FP&L and TECO* at 17.

Some electric companies already charge rates in proportion to the amount of space occupied by the wireless attachments and advocate this position in their comments.²⁰

Electric companies are often monopoly pole owners in a community with no other option for wireless coverage solutions; therefore, they cannot justify setting an unreasonable rate and calling it “market-based rate.” Without the Commission’s intervention, electric companies will continue abusing telecommunications companies who need wireless attachments on utility poles to make expanded or enhanced wireless services available at competitive rates to consumers while making the most efficient use of public spaces and existing infrastructure.

III. IF WIRELESS ATTACHMENTS ARE NOT ALLOWED, TELECOMMUNICATIONS COMPANIES WILL BE FORCED TO SET THEIR OWN POLES.

The discussion above illustrates how some of the electric companies seek to create nonnegotiable barriers to infrastructure access and charge unreasonable rates for wireless attachments. Some electric companies state repeatedly that pole attachments, wireless or otherwise, interfere with their core mission of providing electric service.²¹ However, when the U.S. Congress passed section 224 in the Communications Act of 1934, it decided that telecommunications attachments would be an integral part of a utility pole owner’s responsibility. This policy was instituted to efficiently use existing infrastructure and avoid innumerable separate utility poles running in parallel and cluttering the rights-of-way, which had been causing safety and other issues.

²⁰ In the Matter of Implementation of Section 224 of the Act; Amendment to the Commission’s Rules and Policies Governing Pole Attachments, WC Docket No. 07-245, *Comments of Ameren Services Company and Virginia Electric and Power Company* at 37-38 (filed March 7, 2008) (“*Comments of Ameren & VEPCO*”)

²¹ *Comments of AEP et. al.* at 8.

When electric companies place unreasonable access restrictions and rates on small telecommunications companies, such as ExteNet, they are forced to set additional utility poles in the rights-of-way, thereby defeating the original purpose of section 224 of the Act.

For example, ExteNet is currently constructing a telecommunications network with an electric company that will only allow the attachment of the antenna, but not other wireless equipment, on its utility poles. This means that ExteNet has to set pedestals in the rights-of-way to accommodate the associate equipment, battery backup unit, power supply disconnect, and meter.

As the picture below illustrates, more clutter in the rights-of-way runs counter to the underlying policy of section 224 of the Act.



ExteNet's first priority is to co-locate on existing utility poles. However, when electric companies severely restrict access or set unreasonable rates for wireless attachments, ExteNet is forced to set new poles in the rights-of-way. ExteNet requests that Commission retain the policy of section 224 of the Act and require pole owners share their infrastructure to avoid the setting of new utility poles.

IV. CONCLUSION

ExteNet respectfully requests that the Commission mandate access to utilities poles for wireless attachments at reasonable regulated rates based on a cost-recovery model. The collective comments of the electric companies show that some pole owners are hostile to wireless attachments and seek to charge unreasonable rates for wireless attachments, which either creates a windfall for the electric company or effectively prohibits construction of new telecommunications networks. ExteNet requests only what other telecommunications companies get—protection under section 224 of the Act.

Respectfully submitted,
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APPENDIX A

Begins on the Following Page

Extenet Systems, Inc. • Proposed Nodes

Statement of Hammett & Edison, Inc., Consulting Engineers

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained on behalf of Extenet Systems, Inc., a personal wireless telecommunications carrier, to evaluate the design of node equipment proposed to be deployed in San Francisco, for compliance with appropriate guidelines limiting human exposure to radio frequency ("RF") electromagnetic fields.

Prevailing Exposure Standards

The U.S. Congress requires that the Federal Communications Commission ("FCC") evaluate its actions for possible significant impact on the environment. In Docket 93-62, effective October 15, 1997, the FCC adopted the human exposure limits for field strength and power density recommended in Report No. 86, "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements ("NCRP"). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," includes similar exposure limits. A summary of the FCC's exposure limits is shown in Figure 1. These limits apply for continuous exposures and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

The most restrictive FCC limit for exposures of unlimited duration to radio frequency energy for several personal wireless services are as follows:

Personal Wireless Service	Approx. Frequency	Occupational Limit	Public Limit
Personal Communication ("PCS")	1,950 MHz	5.00 mW/cm ²	1.00 mW/cm ²
Cellular Telephone	870	2.90	0.58
Specialized Mobile Radio	855	2.85	0.57
[most restrictive frequency range]	30-300	1.00	0.20

General Facility Requirements

Base stations typically consist of two distinct parts: the electronic transceivers (also called "radios" or "channels") that are connected to the traditional wired telephone lines, and the passive antennas that send the wireless signals created by the radios out to be received by individual subscriber units. The transceivers are often located at ground level and are connected to the antennas by coaxial cables about 1 inch thick. Because of the short wavelength of the frequencies assigned by the FCC for wireless services, the antennas require line-of-sight paths for their signals to propagate well and so are



Extenet Systems, Inc. • Proposed Nodes

installed at some height above ground. The antennas are designed to concentrate their energy toward the horizon, with very little energy wasted toward the sky or the ground. Along with the low power of such facilities, this means that it is generally not possible for exposure conditions to approach the maximum permissible exposure limits without being physically very near the antennas.

Computer Modeling Method

The FCC provides direction for determining compliance in its Office of Engineering and Technology Bulletin No. 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation," dated August 1997. Figure 2 attached describes the calculation methodologies, reflecting the facts that a directional antenna's radiation pattern is not fully formed at locations very close by (the "near-field" effect) and that at greater distances the power level from an energy source decreases with the square of the distance from it (the "inverse square law"). The conservative nature of this method for evaluating exposure conditions has been verified by numerous field tests.

Site and Facility Description

Based upon information provided by Extenet Systems, Inc., the typical proposed design for nodes is to mount one Kathrein Model 840-10500 omni-directional dualband antenna on a new or existing utility pole. The antenna would be mounted at an effective height between 24 and 40 feet above ground, and the maximum effective radiated power in any direction would be 30 watts at frequencies in the PCS/AWS bands (1710–2170 MHz). No operations are proposed in the SMR/cellular bands (820-870 MHz).

Study Results

For a person anywhere at ground, the maximum ambient RF exposure level due to such an operation by itself is calculated to be 0.00055 mW/cm², which is 0.055% of the applicable public limit. The maximum calculated level at the second-floor elevation of any nearby building* is 11% of the public exposure limit. It should be noted that these results include several "worst-case" assumptions and therefore are expected to overstate actual power density levels from the proposed operation. Figure 3 attached shows exposure levels from the Extenet operation compared with other common RF sources.

No Recommended Mitigation Measures

Since it is to be mounted on a tall pole, the Extenet node antenna would not be accessible to the general public and so, in the absence of other structures of comparable height in the immediate

* Calculated at a distance of 6 feet.



Extenet Systems, Inc. • Proposed Nodes

vicinity, no mitigation measures are necessary to comply with the FCC public exposure guidelines. Power density levels exceeding the occupational guidelines are calculated to extend no further than 3 inches directly in front of the Extenet antennas themselves; due to that short distance, the Extenet operation as proposed can be considered intrinsically compliant with FCC guidelines and no additional mitigation measures are required.

Conclusion

Based on the assumptions and analysis above, it is the undersigned's professional opinion that the node equipment proposed nationwide by Extenet Systems, Inc., will comply with the prevailing standards for limiting public exposure to radio frequency energy and, therefore, will not for this reason cause a significant impact on the environment.

Authorship

The undersigned author of this statement is a qualified Professional Engineer, holding California Registration Nos. E-13026 and M-20676, which expire on June 30, 2009. This work has been carried out by him or under his direction, and all statements are true and correct of his own knowledge except, where noted, when data has been supplied by others, which data he believes to be correct.

April 3, 2008



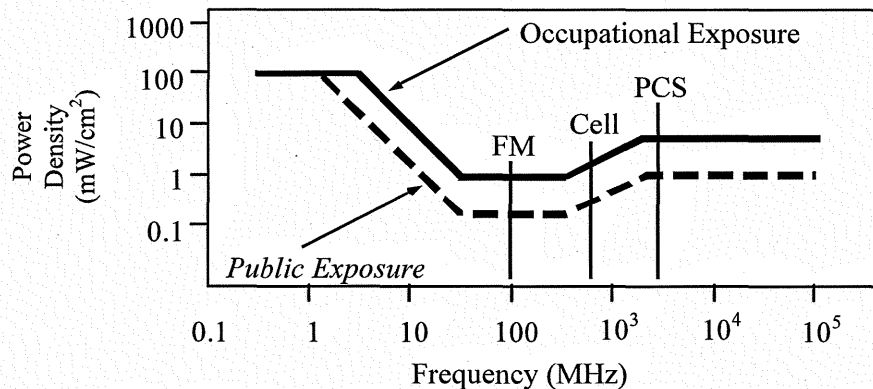
William F. Hammett
William F. Hammett, P.E.

FCC Radio Frequency Protection Guide

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission ("FCC") to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The FCC adopted the limits from Report No. 86, "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements ("NCRP"). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," includes similar limits. These limits apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

As shown in the table and chart below, separate limits apply for occupational and public exposure conditions, with the latter limits (in *italics* and/or dashed) up to five times more restrictive:

Frequency Applicable Range (MHz)	Electromagnetic Fields (f is frequency of emission in MHz)					
	Electric Field Strength (V/m)		Magnetic Field Strength (A/m)		Equivalent Far-Field Power Density (mW/cm ²)	
0.3 – 1.34	614	<i>614</i>	1.63	<i>1.63</i>	100	<i>100</i>
1.34 – 3.0	614	<i>823.8/f</i>	1.63	<i>2.19/f</i>	100	<i>180/f²</i>
3.0 – 30	1842/f	<i>823.8/f</i>	4.89/f	<i>2.19/f</i>	900/f ²	<i>180/f²</i>
30 – 300	61.4	<i>27.5</i>	0.163	<i>0.0729</i>	1.0	<i>0.2</i>
300 – 1,500	3.54√f	<i>1.59√f</i>	√f/106	<i>√f/238</i>	f/300	<i>f/1500</i>
1,500 – 100,000	137	<i>61.4</i>	0.364	<i>0.163</i>	5.0	<i>1.0</i>



Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits, and higher levels also are allowed for exposures to small areas, such that the spatially averaged levels do not exceed the limits. However, neither of these allowances is incorporated in the conservative calculation formulas in the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) for projecting field levels. Hammett & Edison has built those formulas into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radio sources. The program allows for the description of buildings and uneven terrain, if required to obtain more accurate projections.



HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
SAN FRANCISCO

FCC Guidelines
Figure 1

RFR.CALC™ Calculation Methodology

Assessment by Calculation of Compliance with FCC Exposure Guidelines

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission ("FCC") to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The maximum permissible exposure limits adopted by the FCC (see Figure 1) apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health. Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits.

Near Field.

Prediction methods have been developed for the near field zone of panel (directional) and whip (omnidirectional) antennas, typical at wireless telecommunications base stations, as well as dish (aperture) antennas, typically used for microwave links. The antenna patterns are not fully formed in the near field at these antennas, and the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) gives suitable formulas for calculating power density within such zones.

For a panel or whip antenna, power density $S = \frac{180}{\theta_{BW}} \times \frac{0.1 \times P_{net}}{\pi \times D^2 \times h}$, in mW/cm²,

and for an aperture antenna, maximum power density $S_{max} = \frac{0.1 \times 16 \times \eta \times P_{net}}{\pi \times h^2}$, in mW/cm²,

where θ_{BW} = half-power beamwidth of the antenna, in degrees, and

P_{net} = net power input to the antenna, in watts,

D = distance from antenna, in meters,

h = aperture height of the antenna, in meters, and

η = aperture efficiency (unitless, typically 0.5-0.8).

The factor of 0.1 in the numerators converts to the desired units of power density.

Far Field.

OET-65 gives this formula for calculating power density in the far field of an individual RF source:

$$\text{power density } S = \frac{2.56 \times 1.64 \times 100 \times RFF^2 \times ERP}{4 \times \pi \times D^2}, \text{ in mW/cm}^2,$$

where ERP = total ERP (all polarizations), in kilowatts,

RFF = relative field factor at the direction to the actual point of calculation, and

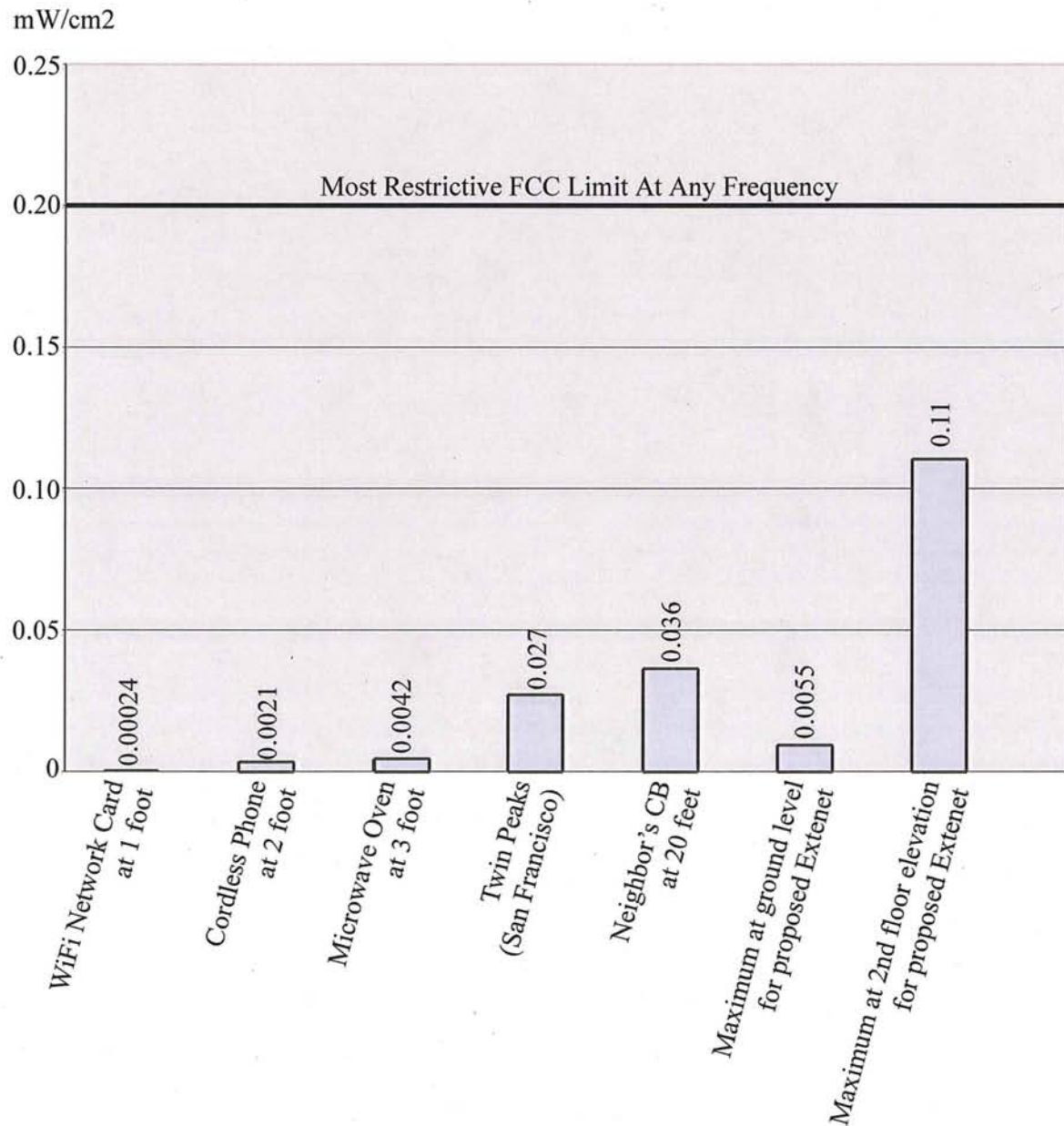
D = distance from the center of radiation to the point of calculation, in meters.

The factor of 2.56 accounts for the increase in power density due to ground reflection, assuming a reflection coefficient of 1.6 ($1.6 \times 1.6 = 2.56$). The factor of 1.64 is the gain of a half-wave dipole relative to an isotropic radiator. The factor of 100 in the numerator converts to the desired units of power density. This formula has been built into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radiation sources. The program also allows for the description of uneven terrain in the vicinity, to obtain more accurate projections.



Extenet Systems, Inc. • Proposed Nodes

Comparison of Representative Power Density Levels for Various Radio Frequency Sources



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